COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Twelfth Annual Report
of the
Sugarcane Research Station
1941

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1911

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SUGARCANE RESEARCH STATION, MAURITIUS

STAFF

Senior Chemist, Officer-in-charge ...	N. CRAIG, M.SC.
Botanist	H. EVANS, PH.D.
Geneticist	G. C. STEVENSON, B.A. (Cantab). A.I.C.T.A.
Cane Breeding Officer	A. DE SORNAY, B.SC. (London), I.A.C. (Paris) (on leave).
Scientific Assistants	P. HALAIS, DIP. AGRIC. (Maur.) G. MAZERY, DIP. AGRIC. (Maur.) A. D'EMMEREZ DE CHARMOY, DIP. AGRIC. (Maur.).
Extra Field Assistant	S. FEILLAFÉ, DIP. AGRIC. (Maur.).
Temporary Field Assistant for control of Uba Scheme	E. M. D'UNIENVILLE.
Clerical Assistant (part time services only) ...	G. H. URRUTY.

RESEARCH ADVISORY COMMITTEE OF THE SUGARCANE RESEARCH STATION FOR THE YEAR 1941

Ex-officio

The Director of Agriculture, *Chairman.*

The Senior Chemist. The Botanist The Geneticist

Nominated by His Excellency The Governor

Mr. L. N. Austin Mr. G Wiehe

Nominated by the Advisory Board of the Mauritius College of Agriculture

Mr. Frederick North Coombes Mr. G. P. Langlois

Nominated by the Sugar Industry Reserve Fund Committee

Mr. Julien Doger de Speville Mr. Pierre de Sornay
(Chevalier de la Légion d'Honneur)

Twelfth Annual Report of the Sugarcane Research Station, 1941

INTRODUCTION

Staff

During the year under review, the Cane Breeding Officer, Mr. A. de Sornay, continued his course of studies for the B.Sc. Examination of the University of London, and I have much pleasure in recording that this officer has passed his final examinations. He had not returned to the Colony at the end of the year, but is expected back early in 1942. Mr. P. Halais, Scientific Assistant in the Chemical Division, was called up for military service with the Mauritius Territorial Force as from 24th November. His temporary absence will be severely felt, as he was a most energetic young officer, with a wide knowledge of local conditions. On account of the scarcity of trained laboratory assistants on estates, it was impossible to employ an assistant for the analysis of canes from experimental plots, and consequently Mr. S. Feillafé was called upon to perform this work, thus further handicapping the work of the Chemical Division. The Senior Chemist was executive officer in charge of the Food Crop Inspection Services, whilst Dr. Evans, Messrs. Stevenson, Halais and d'Unienville were called upon to help in carrying out inspection of the areas under foodstuffs grown in accordance with Government Notices No. 78 and 79 of 1941. As in the previous year, the Senior Chemist was also required to administer Government Notice No. 156 of 1941, which provided for regulating the distribution and sale of chemical fertilizers. It is evident that with all these extra calls upon the staff, the work of the Station must inevitably have been restricted to a certain extent, but in spite of this it is with pleasure that I am able to record that the continuity of the work is being maintained and that definite progress has been made. In this connection it should be noted that a new cane variety, M.112/34, has been released for general propagation, and the demands for planting material of this variety, which have greatly exceeded the quantity available for distribution, show the confidence which the planting community place in the recommendations made by the officers of the Station.

Only one meeting of the Research Advisory Committee was held during the year, in April, 1941, at which the Annual Report for 1940 and the research programme for 1941 were discussed.

Weather conditions for the growth and ripening of the 1941 crop were very varied throughout the year. It will be seen from the table which follows that for the greater part of the year, temperature at Réduit was considerably above normal. Satisfactory showers of rain started in December, whilst in January and February rainfall was considerably above normal, and in many parts definitely excessive,

and at the same time sunshine was, without doubt, deficient. In March and April growth conditions generally improved, but May proved to be one of the driest months recorded for many years, whilst the rainfall in June was also below normal and a severe check in growth occurred. Then in August and September, rainfall was much above the average, and this, combined with the high temperatures, resulted in retarding the maturation of the crop, so that extraction was accordingly lowered. The last three months of the year were dry except for two days in December when heavy rains were fairly generally encountered as a result of thunder storms. In spite of the variable weather conditions during 1941, the preliminary compilation shows that the yield of sugar for 1941 will probably be a record, approximately 323,000 tons of sugar having been produced. It must be pointed out however that the yield of sugar per arpent will probably not be a record, as the area under cultivation has been increased.

Rainfall figures for three stations representative of three different localities of the island, together with figures showing the departure from the average temperature at the Central Experiment Station are given in the following table. These figures have been supplied by the Statistician of the Department of Agriculture.

	Pamplemousses Experiment Station		*Central Experiment Station, Réduit*			*Royal College, Curepipe*	
	Rainfall		*Rainfall*		*Temperature above (+) or below (−) normal*	*Rainfall*	
	Average	*1941*	*Average*	*1941*		*Average*	*1941*
	ins.	*ins.*	*ins.*	*ins.*	*°C*	*ins.*	*ins.*
January ...	9·56	11·13	10·32	13·52	−0·3	16·33	37·46
February ...	8·74	13·32	10·95	10·72	0·0	17·28	21·40
March ...	9·32	3·32	11·94	5·00	+0·8	19·31	6·40
April ...	5·96	7·68	5·41	10·13	+1·0	12·39	21·51
May ...	4·48	0·57	4·24	1·11	−1·0	9·86	3·53
June ...	3·43	1·34	3·11	2·46	+1·0	7·47	5·74
July ...	2·93	2·11	2·75	2·85	+0·8	8·57	10·62
August ...	2·59	5·04	2·47	3·01	+0·6	7·79	10·28
September ...	1·83	2·70	1·71	3·52	+1·2	5·78	11·08
October ...	1·95	1·77	1·91	1·57	+1·0	4·32	7·68
November ...	2·13	1·67	2·33	2·05	+0·5	5·71	7·49
December ...	4·91	9·32	6·39	6·67	+0·1	9·71	14·28
Total ...	57·83	59·97	63·53	62·61		124·52	157·48

In spite of the difficult conditions consequent upon the war situation which the planters as a body have had to face I am pleased to acknowledge the whole-hearted manner in which they have co-operated with the officers of the Station, and to this co-operation must be attributed in no small degree the success which has attended our efforts.

N. Craig, *Officer in charge,*
Sugarcane Research Station.

PART I—GENETICIST'S DIVISION

Cane Breeding—M./41 Series

Cane breeding was carried out, under very favourable conditions during the months of May to July: the majority of the work was done at Réduit and only a few supplementary crosses were made at Pamplemousses. The actual technique of crossing at present in use is regarded as quite satisfactory for Mauritius conditions, and no modifications were introduced during the season. Examinations for sex-determination were made on 120 varieties and new seedlings to determine their status as breeding canes. Certain of these were used in experimental crosses.

In formulating the breeding programme, crosses were evaluated on the basis of their performances in previous years, by means of the progeny test: the result of the continued use of this method from year to year is that the first year seedling populations consist of progressively greater proportions of seedlings from the more promising crosses. At the same time, experimental crosses are made each year, so that populations from the newer seedling varieties are subjected to progeny testing as soon as possible. A considerable amount of information is now available on the relative merits of the most frequently used parent varieties. As examples of this may be quoted the high percentage of heavy arrowing seedlings bred from M.37/26, the low juice quality of seedlings from M.20/16, and the tendency of M.73/31 to give seedlings susceptible to red rot in crosses with certain male varieties.

The variety B.H.10(12), which arrows very rarely in Mauritius, was available for breeding during the season. A number of arrows were found at Rich Fund S.E. and, by kind permission of the manager, were cut and transported to Réduit, where they were used in crosses with the best female varieties available. In this way more than 650 seedlings from B.H.10(12) were obtained. Arrows of M.168/32 were also available, both at Réduit and at Pamplemousses. More than 1,000 seedlings were obtained from this variety which in previous year had been almost non-arrowing.

On account of the necessity for economy in space in this report, it is possible only to give a summarised list of the crosses made and seedlings obtained in the breeding work, as follows—

	No. of crosses made	*No. of lanterns used*	*No. of seedlings obtained*	*No. of seedlings planted*	
				C.E.S.	*P.E.S.*
1. Noble cane breeding (*S. officinarum*) ...	14	18	10,056	2,274	1,543
2. Nobilisation of *S. spontaneum* —					
(*a*) Java type (112 chromosomes):					
3rd nobilisation	1	1	6	5	0
4th nobilisation	5	8	470	291	30
5th nobilisation	25	41	12,545	3,730	3,111
6th nobilisation	9	9	4,455	835	831
mixed " glagah " crosses ...	5	7	3,287	832	258
(*b*) N. Celebes type (80 chromosomes):					
2nd nobilisation	1	1	42	40	0
3rd nobilisation	2	2	250	95	180
(*c*) Indian type (64 chromosomes):					
2nd nobilisation	1	1	13	12	0
3rd nobilisation	2	3	23	21	0
3. Nobilisation of *S. barberi*:					
2nd nobilisation	1	1	4	4	0
mixed *barberi* crosses	2	1	177	135	0
4. Crosses involving several *Saccharum* spp.:					
(*a*) *S. officinarum*, *S. spontaneum* (Java) and *S. spontaneum* (India) ...	17	26	4,831	978	680
(*b*) *S. officinarum*, *S. spontaneum* (Java) and *S. spontaneum* (N. Celebes) ...	2	2	455	204	144
(*c*) *S. officinarum*, *S. spontaneum* (India) and *S. barberi*	1	2	9	7	0
(*d*) *S. officinarum*, *S. spontaneum* (Java) and *S. sinense*	3	3	12	12	0
(*e*) *S. officinarum*, *S. spontaneum* (Java), *S. spontaneum* (India) and *S. barberi*	1	3	111	12	75
(*f*) *S. officinarum*, *S. spontaneum* (Java) and *S. barberi*	1	2	5	5	0
(*g*) *S. officinarum*, *S. spontaneum* (Java), *S. spontaneum* (India) and *S. barberi*	3	4	232	120	60
Totals	96	136	36,983	9,612	6,912

Germination of fuzz was satisfactory. The number of seedlings produced per lantern was highest in the noble crosses. In the "glagah" blood line it was rather low in the early nobilisation stages, but good in the 5th and 6th nobilisations. Incompatibility was in evidence in many of the complex inter-specific crosses, which showed poor germination in several cases. Such incompatibility is met with year after year in the breeding work, although new combinations of parents are continually made. The desirability of producing improved inter-

specific hybrids, both for trial under particular conditions and for use as parents in special breeding lines, is however regarded as sufficient justification for persisting with this type of cross.

The above table also shows the numbers of seedlings planted in the field at both Stations. Those allocated to Pamplemousses Experiment Station were sent in the box stage, and potted there, except for the few crosses made at that Station.

Field plantings were made during December at both Stations.

First Year Trials—M./40 Series.

Selections were made in the first year trials at Réduit in November—December, and 71 seedlings were considered worthy of further trial. At Pamplemousses in November, 91 seedlings were selected. All such selections were planted in multiplication plots, to provide material for planting second year trials.

Though actual figures of weight and brix are recorded at the time of seedling selection, it will be evident that such figures are of relative value only. Selection standards must be adjusted for season, locality, field, and frequently for such fluctuations in fertility, as can be detected within a single field. To assess the value of the genotype expressed in the seedling as a result of the conditions of its growth, should be the aim of the selection work. In addition to the recording of seedling weights and juice quality, therefore, more attention is now paid to *relative merits* in these respects; a system of symbols has been devised for recording seedling characters, not only in the first year trial, but also in subsequent stages of the testing scheme. This system, though arbitrary, has proved of some considerable value during the three years it has been in use.

The majority of the first year selections comprise the series for the general scheme of trials. In addition, however, certain seedlings were allocated for testing under poor soil conditions in a special series of trials which was begun last year. These trials are referred to in the section devoted to Second Year Trials.

Of the first year seedlings, 0·7% were selected for further trial at Réduit, and 1·4% at Pamplemousses. Detailed analysis of the selection figures for individual crosses yielded important information on the breeding value of the parent varieties. In this connection it is of interest to note that the newly released variety M.112/34 shows considerable promise as a female parent. Other valuable female parents are Ba.11569 and M.134/32, both of which have consistently given a high proportion of seedings of good type.

Second Year Trials.

In the general testing scheme, " moyenne saison " second year trials were laid down at Réduit in April to test seedlings of the M./38 series. At Pamplemousses, two series of trials were planted. These included seedlings of the M./39 series and were planted in June and August

respectively. The majority of these seedlings were sent from Réduit for trial at Pamplemousses, and will also be planted under " moyenne saison " conditions at Réduit. The testing of the same seedlings under different lengths of growing season at so early a stage in the scheme of trials is felt to be a valuable innovation in the work of this Division. The comparative performances of seedlings under one set of conditions need not of necessity hold under different conditions of climate or soil. In fact the whole question of adaptation of a variety to its most suitable environmental niche is bound up with the differential responses shown by varieties under distinct growth conditions. This is one of the main difficulties of variety testing, and it could be completely overcome only by selecting seedlings in districts representative of all the ecological areas which are to be served. Such a procedure is impracticable for evident reasons.

During the crop season, seedlings of the M./37 series were reaped in second year trials at Réduit, and of the M./38 series at Pamplemousses. From these trials, a total of fifteen seedlings was allocated for third year trials. The selections were also planted in the gumming disease resistance trial.

Seedlings specially selected for trial under poor soil conditions were planted at Réduit in a field known to be of fundamentally low fertility. They are un-irrigated, and given reduced fertilizer applications. Both " grande saison " and " petite saison " trials are represented, and the seedlings included are selections from the M./38 and M./39 series, both from Réduit and Pamplemousses.

Third Year Trials.

Only one third year trial was planted at Pamplemousses in August. Selections from the second year trials at Réduit were planted in multiplication plots, to provide planting material for " grande saison " third year trials to be planted next March-April. Seven trials were reaped during the crop season, four in virgin canes and three in first ratoons. Five seedlings were selected from these trials, and will later be planted in variety trials. These are M.7/36 (R.P.6 x M.72/31), M.64/36 (Ba.11569 x M.72/31), M.144/36 (R.P.6 x M.72/31), M.151/37 (R.P.6 x S.C.12/4), and M 234/37 (R.P.6 x M.27/16). All these varieties have been selected from trials in which their performance was compared with those of the new standard canes M.171/30 and M.134/32. They will be put into trials on estates when sufficient planting material is available.

Variety Trials.

The variety trials reaped during the crop season of 1941 were concerned mainly with the behaviour of the three varieties M.112/34, M.177/35 and M.185/35 in comparison with that of the standard varieties in several localities. The fact that all three of these gave mean yields, both of cane and of sucrose per arpent, equal to or greater than that of the new standard variety M.134/32, is a cause for great

satisfaction, for it represents the chief ultimate justification of the selection methods employed in the earlier series of trials in the testing scheme. The results obtained in the seven variety trials which contained these varieties are given in tabular form below—

		M.112/34		M.117/35		M.185/35		M.134/32	
		Tons cane per arpent	*Sucrose % cane*	*Tons cane per arpent*	*Sucrose % cane*	*Tons cane per arpent*	*Sucrose % cane*	*Tons cane per arpent*	*Sucrose % cane*
Union (Flacq);	16½ months ...	39·6	13·43	37·2	13·54	39·7	11·65	35·0	12·99
Medine;	16½ months ...	49·6	15·93	47·3	14·45	48·1	13·84	46·0	15·51
Beau Plan;	15 months ...	45·9	13·81	—	—	48·2	10·91	45·3	12·24
Beau Bois;	14 months ...	35·1	14·63	34·2	12·95	40·9	12·69	37·6	13·69
Union (Ducray);	15½ months ...	53·7	16·12	47·2	15·53	51·3	14·60	56·7	15·04
Solitude;	16 months ...	51·6	15·57	58·2	15·08	59·2	13·74	53·4	16·05
Sans Souci;	14 months ...	30·4	15·14	36·7	13·50	40·5	13·65	27·2	14·05

Treated statistically, these figures showed that none of the three varieties in question differed significantly in sucrose yield per arpent from M.134/32. So far as the trial results go, therefore, the varieties are equal in yield to this standard cane. In applied biology, however, unsupported numerical data are apt to be misleading, and in considering the release of these varieties for general cultivation, ancillary, non-yield characteristics were regarded as of considerable importance.

M.112/34 was released in December, and there were very heavy demands for planting material. A short paper was prepared for publication in the *Revue Agricole*, describing the features of this new variety, and the results so far obtained with it in its trials. It is of a good growth type, healthy, and particularly promising in regard to juice quality. Of the other two varieties, M.177/35 is the better, but its performance under "grande saison" conditions in variety trials, and its ratooning capabilities must be considered before the question of its release is decided. M.185/35 is unlikely to be released on account of its rather low juice quality and its susceptibility to red rot disease.

Nine variety trials were cut in ratoons. It is impossible to give the full results in this brief report, but it may be said that valuable information on the ratooning capabilities of the previously released varieties M.171/30, M.72/31 and M.134/32 was secured. It has been found from these and previous trials, for instance, that the juice quality

of M.171/30, which may be low in coastal districts, is generally satisfactory in comparison with other varieties in the higher, cooler and heavier rainfall regions.

Disease Resistance Trials.

The routine gumming disease testing was continued. The trials are organised in such a way that information on the susceptibility of seedlings is made available before their third year trials are cut. Some progress was also made in the red rot resistance testing work, and it is hoped that regular resistance testing of new seedlings may be begun next season. It all this work, the valuable co-operation of the Plant Pathologist, Department of Agriculture, is acknowledged.

Investigations on Arrowing Phenomena in P.O.J.2878.

In any experiments which are made with the object of instituting or controlling the arrowing phase in sugarcane, it is evidently important to know at what stage the arrow initials are normally laid down in the growing point of the stem. In an examination of canes of P O.J. 2878 made on 27th March, almost six weeks before arrows emerged in this plot, and when there were no external signs of arrowing whatsoever, it was found by dissection that 74% of the canes contained arrow initials varying in length from $\frac{1}{8}''$ to $\frac{1}{2}''$. Three weeks later, on 17th April, there were external signs of arrowing, as indicated by lengthening of the younger leaf-bases in the spindle. At this time, canes showing the earliest visible signs of arrowing were found by dissection to have young arrows 4 to 5 inches in length. The arrows in the plot finally began to emerge in the first week of May. From these facts, it is evident that conditions which may effect the time or extent of arrowing in a variety are those in operation *at least* six weeks before the normal time of arrow emergence. It is probable, indeed, that the critical time is considerably earlier than this.

The flowering characteristics of P.O.J.2878 were also investigated in some detail, both at Reduit and at Pamplemousses. Briefly, it was found that for individual arrows, the flowers opening in the earlier days of the flowering period appeared to be completely male fertile, with almost 100% anther dehiscence and normal pollen, which was often found germinating on the stigmas. Half way through the flowering period, anther dehiscence was noted as 60–70%, but in the later stages, flowers at the base of the arrows showed a low dehiscence percentage, and the arrows at this stage were often almost male-sterile. It is possible that conditions of growth and environment may profoundly influence this sex-expression, and this may account for the erratic results obtained from year to year in selfings of P.O.J.2878 to determine the extent of its male-sterility, and also in using it as a male parent. Fortunately, two completely male-sterile seedlings of P.O.J.2878, known to be crosses (M.134/32 and M.112/34) are proving excellent female parents, and a third (M.72/31) is promising as a male. One of these three is used generally in breeding at the present time when the blood of P.O.J.2878 is required in a cross.

Experiments with the drug Colchicine.

These experiments were briefly mentioned in the Annual Report for 1940. Some hundreds of seedlings from treated fuzz were examined in the field during the crop season, and compared with control plantings. There did not appear to be any greater variability in the treated populations, nor were any outstanding seedlings found in them, though some were selected for further trial. It should be remembered that the term " variety " in reference to sugar cane is one of convenience only ; even so, it is preferable to the pedantic " clone ". The individuals are generally complex heterozygous polyploids and aneuploids, so that a high degree of variation is expected in seedling populations. Consequently, inducing polyploidy by artificial means is likely to be less successful than in simple diploid plants.

Experiments were continued during the season under review. Seedlings showing abnormalities in the early stages following treatment, were fixed for later cytological examination. Further plantations of treated individuals were made in the field.

Single-eye cuttings of B.H.10 (12) in early stages of germination were treated with colchicine solutions, and are under observation.

Notes on other work.

(1) An investigation on the hairiness of leaf-sheats in varieties was begun. Hairy leaf-sheats in some varieties are objectionable, particularly to labourers during field work and at reaping. Morphological examinations were made, measurements recorded, and varieties classified on the basis of this characteristic. Information on its inheritance in breeding is being obtained.

(2) Cuttings of some new varieties were handed to the Botanist for inclusion in a trial in which regular measurements of growth and periodicity in varieties under Reduit conditions are being made.

(3) Planting material of sugarcane hybrids to be tested as fodder canes was exported to the East African Agricultural Research Station, Amani. Plantings were also made at Réduit.

(4) Fuzz of various selected crosses was exported to the Ministry of Agriculture, Egypt, to the East African Agricultural Research Station, Amani, and to the Experiment Station of the South African Sugar Association, Natal.

(5) Various reports and articles were written on sugarcane varieties and seedling testing for publication in the *Revue Agricole*.

Acknowledgements.

The writer wishes to express his appreciation of the valuable help received during the year from several Divisions of the Department of Agriculture.

G. C. STEVENSON,
Geneticist.

PART II—CHEMISTRY

The work of the division, which has been chiefly concerned with soils and fertilizers in connection with sugarcane, has been severely handicapped by the calls made upon officers of the Division in connection with duties of a war-time nature. Mr. Feillafé was called upon to undertake the analysis of cane samples, as there was no suitable candidate available for the post of Cane Analyst. Mr. P. Halais was therefore required to do much of the field work in connection with field experiments, and this officer was called up for military service on November 24th. The Senior Chemist was also responsible for the scheme for rationing chemical fertilizers, and he was appointed Food Production Officer to administor, under the Director of Agriculture, Government Notices No. 78 and No. 79 of 1941, dealing with the production of planting material of manioc and sweet potatoes and of seed maize. Consequently the amount of work which could be performed in the laboratory was seriously curtailed.

Soil Mapping.

The general mapping of soils throughout the Colony was completed, but it must be emphasized that the maps prepared are not on a sufficiently detailed scale to show all the minor changes which may be encountered, such as small patches of free soils in an area which is predominently rocky. It does, however, give a very good idea of the general distribution of the different soil types in the island. This map, in conjunction with maps prepared some time ago showing the distribution of soils between estates with mills, estates without mills and big planters, and small planters, is useful for advisory work.

In one case, the Senior Chemist was called upon to advise upon the possibility of irrigating a portion of the district of Grand Port. The maps referred to above gave a very good general picture of the situation, and allowed of a very thorough detailed examination of the area to be made easily. As a result of this survey, it was recommended that the area in question was not suitable for irrigation for the following reasons:—

(*a*) The broken nature of the ground in parts.

(*b*) The highly cavernous nature of the underlying volcanic rocks.

(*c*) The gravelly nature of the soil, rendering it very porous.

(*d*) The excessive quantities of water which would be required.

(*e*) An apparent lack of response to irrigation. Some fields in this area were irrigated, but did not give much higher yields than adjacent non-irrigated fields with the same variety and in the same category of ratoons.

Foliar Diagnosis.

Much of the laboratory work consisted in determining the chief plant foods in the leaves, and in addition the amounts in the mature cane stalks at harvest. Many of the analyses performed were in connection with manurial trials, but in addition samples of leaves were taken from eighteen different factory areas, the canes sampled in

each factory area being as far as possible of the same variety and age from plantations made by the estate, by the big planters and by small planters to determine as far as possible the effects of (*a*) climatic conditions (*b*) the type of holding, upon the nutrition of the cane.

The analysis of leaf samples from manurial trials, consisting of the 3rd fully expanded leaf from the top, in climatic conditions suitable for optimum growth—about February or March—continues to produce fresh evidence that, in so far as phosphates and potash are concerned, the method of foliar diagnosis is reliable. Field experiments have now been started which will enable fuller investigation to be made with respect to nitrogen in the leaf, and periodical analyses of samples taken from these trials will be made throughout the season. As a result of analyses carried out in the years 1938–1941 inclusive, the mean N, P_2O_5 and K_2O contents of the selected leaves of canes grown according to best local practice are as follows—

	N	P_2O_5	K_2O
% dry matter of the leaf ...	1·38	0·38	2·18

In confirmation of this, the analyses of similar samples taken from the eighteen estate canes mentioned above give the following figures for the year 1941.

	N	P_2O_5	K_2O
% dry matter of the leaf ..	1·33	0·38	2·15

If the canes are in full vegetation in February, and if analysis shows the leaves to be deficient in either nitrogen or potash, then it is still possible that supplementary applications of the necessary fertilizers will be of value to the forthcoming crop, but it will in all probability be too late to apply phosphatic fertilizers. This deficiency may however be corrected in the following crop.

The analysis of leaves taken from different climatic zones and different types of holdings show extremely interesting results. Unfortunately the month of March, when the samples were taken, was rather dry, but as all samples would be similarly affected, it is not thought that the results obtained would be seriously affected. The following tables give the mean results for each type of holding in the three different climatic zones, for both the phosphate and potash contents. Each of these figures represents therefore the mean of six determinations.

Phosphate (P_2O_5% dry matter of the leaf)

	Estate	*Big Planters*	*Small Planters*	*Mean*
Dry < 60″ rainfall	0·368	0·363	0·357	0·363
Humid 60″–100″ rainfall	0·375	0·328	0·345	0·349
Very Humid > 100″ rainfall	0·385	0·363	0·348	0·366
Mean	0·376	0·351	0·350	General Mean 0·359

Significant difference between means = 0·019

Potash (K_2O% dry matter of the leaf)

	Estate	*Big Planters*	*Small Planters*	*Mean*
Dry < 60″ rainfall	2·14	2·02	1·89	2·02
Humid 60″–100″ rainfall	2·14	1·78	1·84	1·92
very humid > 100″ rainfall	2·16	1·95	1·82	1·98
Mean	2·15	1·92	1·85	General mean 1·97

Significant difference between means = 0·08

In each of these tables, there appears to be one anomalous result, *i.e.*, that for the big planters in the humid area, both being abnormally low. With reference to phosphates, climatic conditions do not appear to have any definite effect upon the P_2O_5 content of the leaves, but these figures show that the canes of big planters and of small planters are much lower in P_2O_5 than are the estate canes in the same area. With respect to potash, the conclusion can also be drawn that the type of holding is the deciding factor as to whether the canes obtain sufficient potash or not, climatic conditions being comparatively unimportant.

Analysis of variance was performed on the whole fifty-four results with both P_2O_5 and K_2O, and the following conclusions emerge: With respect to phosphates, the only factor which definitely affects the amount of P_2O_5 in the leaf is the type of holding, the climate and mill area having no definite effect. For potash, however, the type of holding and also the mill area cause significant differences, climate being apparently without effect. These conclusions agree with what is known of the manurial practices on the different types of holding, namely, that the most complete type of manuring is practised on estates, followed by the big planters, small planters as a rule relying on a very incomplete type of manurial programme, sulphate of ammonia being by far the most common fertilizer used by them. It would appear that big increases in the sugar crop of the Colony would follow the use of a more rational fertilizer programme by the planters, particularly by the small ones. Experience in the Lallmatie area has shown that small planters may be induced to adopt improved methods if they are shown in their own fields the improved crops which they may get as a result of using such methods.

Composite samples from the different types of holdings were prepared, and it was found that the samples from estates contained more P_2O_5 and K_2O, less CaO and MgO and approximately the same amounts of N and Cl as those from planters lands.

The work performed in connection with the analyses of mature cane stalks is of a preliminary nature, but it appears to be fairly definitely shown that the amounts of P_2O_5 and K_2O in the mature cane is correlated with the corresponding amounts in the leaf, but the number of analyses yet performed is insufficient to draw very definite conclusions, and the effect of variety cannot so far be fully known.

Manurial Experiments.

Experiments dealing with the optimum quantity of nitrogen, phosphate and potash

Nitrogen Experiments

Three experiments dealing with the optimum quantity of nitrogenous fertilizers to be applied to sugarcane were reaped during the year, two of them dealing with the virgin crop and one with fourth ratoons. The two virgin trials were situated at Labourdonnais S.E. and at Solitude S.E., the variety in both trials being the same,

viz. M.134/32, and there were four different treatments in each, viz. 0, 75 kgs., 150 kgs., and 225 kgs, per arpent. The Solitude trial was irrigated but that at Labourdonnais was not.

The results from these two trials are given below—

	Labourdonnais S.E.		*Solitude S.E.*	
	Yield in tons per arpent	*Available sugar% cane (98·5 pol.)*	*Yield in tons per arpent*	*Available sugar% cane (98·5 pol.)*
0 kgs. Sulphate of Ammonia	31·3	13·29	40·9	12·34
75 ,, ,,	33·2	13·97	44·3	11·78
150 ,, ,,	32·4	13·21	45·8	12·08
225 ,, ,,	33·5	12·49	47·9	10·38

In both cases there is evidence that there has been a certain increase in yield following the application of sulphate of ammonia, especially in the case of Solitude. In both cases, however, the highest application has had a depressing effect upon the sucrose content of the cane, and it is evident that 225 kgs. of sulphate of ammonia in both experiments was definitely above the optimum. It would appear that the optimum would lie between 75 and 150 kgs., with a probability that the optimum would be nearer to the lower figure.

The fourth ratoon trial was situated at Solitude S.E. and was reaped experimentally for the third time; the treatment given to the different plots has remained constant through the three crop periods, at 0 kg., 100 kgs., 200 kgs. and 300 kgs. per arpent. The results for the 1941 reaping, together with the mean results for the three crops 1939, 1940 and 1941 are given below—

Solitude S.E.	*B.H.10/12, 4th ratoons*	
	Yield in tons per arpent	
	4th ratoons 1941	*2nd 4th ratoons 1939–41*
0 Sulphate of Ammonia	26·5	21·9
100 kgs. ,, ,,	27·1	22·4
200 kgs. ,, ,,	29·8	23·2
300 kgs. ,, ,,	30·0	24·0

Unfortunately the analysis of these canes could not be carried out, but it is doubtful if the increases obtained would be sufficient to warrant the use of large quantities of nitogenous fertilizers, especially when the mean results for three years are considered.

In view of these results, several new experiments have been started to determine the optimum dressing of nitrogenous fertilizers, and in some of the experiments a comparison between equivalent dressings of sulphate of ammonia and nitrate of soda has been included.

Potash Trials

Two optimum quantity of potash trials at Beau Séjour S.E. were reaped for the first time, but in neither case was there any definite response to potash. A similar trial at Cascado S.E. was harvested for the third time, but this year there was no significant difference between any of the different series of plots, although in the two previous years there had been some apparent increases.

Kind of Phosphate Trial

This trial, reaped in fourth ratoons at Bel Ombre S.E. still shows no response to any of the phosphatic fertilizers, in spite of the fact that no phosphate has now been applied to the control plots for five successive crops.

Phosphate and Potash Trials (Qualitative)

Trial Bio 5 at Central Experiment Station, Réduit

The complete fertilizer plots received 150 kgs. of sulphate of ammonia, 150 kgs. of phosphatic guano and 100 kgs. of sulphate of potash. The —P and —K plots received no phosphatic guano or sulphate of potash respectively. The trial, planted with M.134/32, was reaped in 1st ratoons at an age of 11 months and the following results were obtained,

Series	*Yield in tons of cane per arpent*	*Sucrose % cane*
Complete fertilizers ...	40·7	16·77
No phosphate ...	35·5	16·59
No potash ...	33·5	15·90
Significant difference ...	6·6 tons per arpent	

In the first ratoon crop, incomplete fertilization has resulted in considerable reductions in yield, though the reduction due to lack of phosphates is not significant. This year, however, the omission of potash has had a more serious effect than that of phosphates, which is contrary to what happened in the virgin crop. The omission of phosphates had no apparent effect upon the sucrose content of the cane, but when no potash was applied, there was an immediate drop in the sucrose content, amounting to 0·9%. From this and previous results it appears that lack of phosphates may show itself more in the virgin crop than in succeeding ratoon crops.

Trial Bio 9 at Cascade Rose Belle S.E.

This trial was reaped in 3rd ratoons, and for details of the layout previous reports should be consulted. The fertilizer programme for this crop was the same as for the preceeding, and the results obtained are as follows—

	White Tanna			*B.H.10/12*		
	Yield in tons per arpent	*Sucrose % cane*	*Purity*	*Yield in tons per arpent*	*Sucrose % cane*	*Purity*
Complete fertilizers ...	18·1	15·28	88·9	17·8	14·73	88·5
No phosphatic fertilizers...	17·0	14·38	88·1	15·9	14·91	90·5
No potash fertilizers ...	13·9	14·58	88·1	11·9	13·10	86·8

The outstanding result, as in previous crops, is the big reduction in yield caussd by elimination of potash from the fertilizer programme, and also the accompanying marked drop in sucrose content of the cane at the same time. It also appears that White Tanna is equally suited to this region as B.H.10/12, the sucrose per arpent in the differently treated plots being very nearly the same for the two varieties.

High Applications of Fertilizers versus Small Applications.

Trial 69 (2nd rotation)

This trial was reaped in 2nd ratoons, the treatment having been the same as in the previous year, *i.e.*, B plots receiving four times as much fertilizer as the A plots. The results obtained are as follows—

	M.134/32			*M.131/30*		
	Yield in tons per arpent	*Sucrose % cane*	*Purity*	*Yield in tons per arpent*	*Sucrose % cane*	*Purity*
A Plots ...	25·5	13·9	88·8	17·6	14·0	91·3
B Plots ...	36·5	15·6	91·7	31·4	14·4	90·4

As in previous years, the B plots have greatly outyielded the A plots, in this area of low fertility. Another point which has been noted in former years is that the variety M.171/30 gives a bigger response than M.134/32, which bears out the findings of the Geneticist that in areas of high fertility M.171/30 is capable of giving similar yields in the field to M.134/32. As will be seen, in the case of both M.134/32 and M.171/30 the higher application has resulted in an increased sucrose content in the cane, but the increase is greater in the case of the former.

Cultivation Experiments.

A time of planting and harvesting trial situated at Rose Belle S.E., designed to elucidate certain points in connection with low yields in first ratoons, was reaped in 1940 as the virgin crop and in 1941 as 1st ratoons. The results obtained do not permit of any definite conclusions, but the experiment is being continued.

Only one forking and earthing up trial was reaped this year at Solitude S.E. but the previous conclusions were confirmed, viz., that earthing up has shown an increased yield, whereas forking has had practically no effect.

Uba Replacement Scheme in the Lallmatie, St. Julien, etc., areas.

Very considerable progress has been made in replacing the low-grade Uba de Rich Fund cane varieties, and it is confidently expected that the whole programme of replacement will be terminated within the period prescribed by law. Up to the present there has been little opposition to the scheme and little discontent caused by it, which seems to indicate that where the necessary advice and instruction is given, then a big improvement in the canes supplied by small planters may be expected. From the experience gained in this area, it would appear that the main method by which improvements can be effected is to lay down a large number of small demonstration plots dealing with improved cane varieties, cultural methods and manurial

treatments in different localities. In many cases, small planters, who have been unwilling to accept verbal advice, have been very ready to adopt new methods which they have seen to be good in demonstration plots on their own or their neighbour's lands.

The general improvement in the cane supplies from the St. Julien d'Hotman and Lallmatie areas is very well illustrated by the following table which shows a progressive increase in the quantity of good canes and a decrease in the low grade Uba de Rich Fund canes. It will be noticed that the increase in good canes is greater than the decrease in Uba canes, and this is probably explained by the bigger area now under cane cultivation.

Tonnage of canes supplied to the chief factories from the St. Julien d'Hotman and Lallmatie areas—

Crop	*Good canes*	*Uba canes*
1939–40 ...	65,870 tons ...	17,160 tons
1940–41 ...	77,130 ,, ...	14,075 ,,
1941–42	90,450 ,, ...	7,265 ,,

A large amount of the Uba cane in the 1941-42 crop was cut early in the season and much of it was uprooted for replanting with the new varieties or under food crops. The varieties which are most popular with planters in this area are M.134/32 and M.171/30, but there was little demand for planting material of these two varieties from outside sources, because of the acreage now grown within the area.

There are now four small variety plots cultivated by planters under the direction of the Field Officer in charge of the Uba Replacement Scheme, and whilst the results from any one plot for an individual crop are very unreliable, the whole when taken together gives a very good idea of the yielding capacities of the different canes. From these results it is quite clear that the variety M.134/32 is best suited to the Lallmatie area, followed by M.171/30. A new plot, with eight replications of M.134/32 and seven replications of M.112/34, a variety released for general propagation in December, 1941, has been established with the object of determining its value and to provide planting material for distribution at the end of 1942.

Low grade varieties of canes.

A preliminary investigation into the sucrose content of certain reputed low grade varieties of canes was performed, by the help of the Chemists of the Central Board. Co 301 was found to be generally on the low side, Canne Cent Tonnes Batard to be variable—possibly because this so called variety really consists of several varieties of similar type —whereas M.168/32 which has not been released because of doubts as to its quality and because of its susceptibility to red rot was generally of a fair richesse.

Control of Chemical Fertilizers.

For the fertilizer control year 3rd June, 1940, to 2nd June, 1941, all estates and planters were able to get the full amount of fertilizer allotted to them, but only 60% could be taken as sulphate of ammonia, the remainder being available as Chilean nitrates. Indian nitrate of potash was not controlled during the afore-mentioned period. On account of increased difficulties which were expected during the year 3rd June, 1941, to 2nd June, 1942, it was decided that all nitrogenous fertilizers, including sulphate of ammonia, Chilean nitrates, Indian nitrate of potash, ammonium phosphate, etc., should be under control. A further change introduced was that, whereas in 1940–41 allotments were based upon the quantities used in normal times, estates and planters were allotted quantities on a regional basis. Thus in dry districts without irrigation, the allotment was made on the basis of 100 kgs. of nitrate of soda per arpent, whereas in the very wet districts, the quantity allotted was 167 kgs. per arpent. Those quantities in general represent reductions on the quantities normally used, and up to the end of 1941, the distribution only amounted to the equivalent of 78·3% of the allotment. This distribution is made up as follows: the equivalent of 13·3% nitrate of soda in the form of sulphate of ammonia and 65% in the form of Chilean nitrate or Indian nitrate of potash. It seems highly probable therefore that the 1942–43 crop will suffer from a lack of nitrogenous fertilizers. The position with respect to potash and phosphatic fertilizers was quite satisfactory, potash having been received from India and Chili in the form of nitrates, and phosphatic guano from the guano islands of the Indian Ocean.

Food Production.

At the beginning of the year, plans were prepared for extension of food-stuff cultivation, but it would have been extremely difficult to go full scale production because of the lack of planting material of the selected food-stuffs. Consequently all owners or occupiers of more than 100 arpents of cultivated land were required to propagate areas of manioc, sweet potatoes, and to produce and store certain quantities of seed maize under Orders made by the Food Controller under Article 3 of the Food Control Regulations, 1941. An inspection service under the control of the Senior Chemist was organized to see that the orders were effectively put into operation. The whole island was divided into four production areas, a Regional Food Production Officer, with assistants, being placed in charge of each. With few exceptions, the areas of manioc and sweet potatoes were properly established before the end of the year. A large proportion of the seed maize was stored from the summer crop, which was harvested about June or July, but in spite of treatment much of it had become useless for seed purposes by the end of the year due to insect attack. Out of 150 tons of seed maize required, not more than about 60 tons was in viable condition in December. Further experiments are being carried out by the Entomological Division to find a b tter method for storage of seed maize in bulk.

N. CRAIG,
Senior Chemist.

PART III—RESEARCH BOTANY

Experiments on the Time of Application of Fertilizers.

Trials on this subject, which have been described in previous Annual Reports, were harvested as second ratoons in the present year.

The yields obtained in the various trials are given below—

Treatments.

(for details of treatments see 1940 Annual Report)

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*Gen. Mean*	*Sig. Diff.*
Médine S.E. ...	42·0	40·0	41·8	37·1	40·8	39·2	40·3	42·9	40·51	3·51
St. Aubin S.E. ...	30·0	29·5	29·4	28·7	29·4	28·8	29·0	28·5	28·95	2·58
Beau Vallon S E.	39·4	36·8	37·3	35·6	37·5	38·0	36·3	35·1	37·11	3·00
Beau Champ S.E.	26·5	25·5	26·0	20·4	27·7	25·3	27·2	28·2	25·85	3·81
Union Park S.E.	Owing to circumstances beyond our control this trial could not be harvested in the present year.									
Grand total (all trials)...	137 9	131·8	134·5	121·8	135·4	131·3	132·8	134·7	132·42	
Means ...	34·5	32·9	33·6	30·6	33·8	32·8	33·2	33·7	33·1	1·61

The results for second ratoons show that treatment D which received no fertilizer treatment in first or second ratoons has a significantly lower yield than the remaining plots. The differences between the various times of application do not reach full significance, but indicate, as in previous years, that treatment A (all fertilizers applied in one dose at planting in the case of virgins and as soon as possible after the harvesting of the previous crop in the case of ratoons) may be superior to all other treatments. This is still more apparent when the total yields over three crops are considered. These are given below—

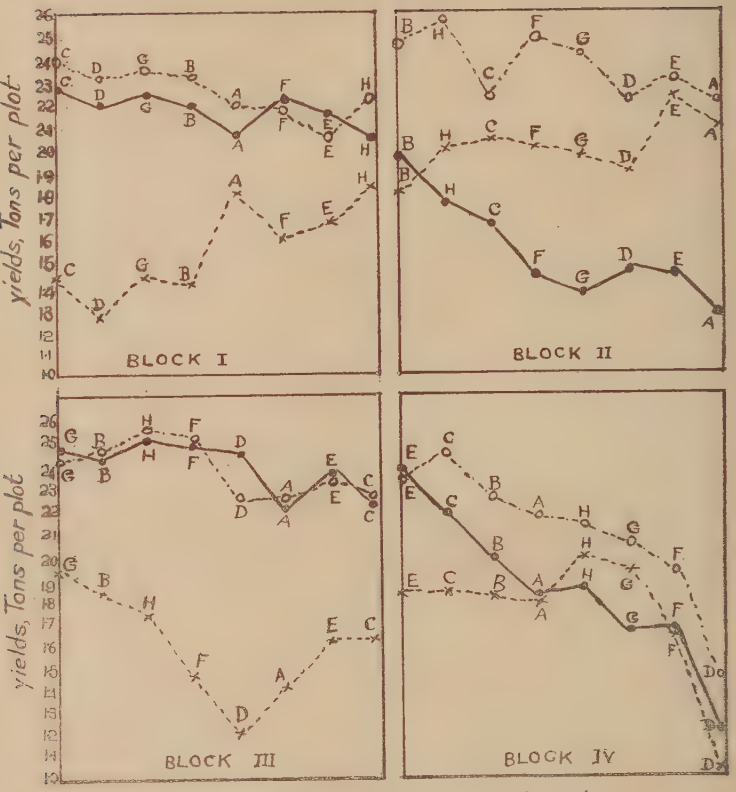
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Médine S.E. ...	136·9	132·4	132·1	125·4	126·6	134·5	130·9	130·2
St. Aubin S.E. ...	102·1	99·7	100·0	99·3	102·1	97·3	96·8	96·1
Beau Vallon S.E.	118·0	110·5	112·0	105·2	112·4	114·1	108·8	105·3
Beau Champ S.E.	85·9*	92·3	92·9	78·6	92·9	86·2	89·7	92·0
Totals ...	442·9	434·9	437·0	408·5	434·0	432·1	426·2	423·6
Mean yields p.a. per crop ...	36·91	36·24	36·42	34·04	36·17	36·01	35·52	35·30

Sig. diff. 0·90 tons

These results establish the facts (*a*) that when no fertilizer at all is applied the yields deteriorate fairly rapidly, (*b*) that late applications are significantly less effective than early applications Actually the results for Medine, St. Aubin and Beau Vallon prove conclusively that the A treatment is superior to the other treatments as will be seen from the yields of these estates, excluding the results for Beau Champ—

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Total yields for Médine, St. Aubin and Beau Vallon	357·0	342·6	344·1	329·9	341·1	345 9	336·5	331·6
Mean yields tons per arpent per crop	39·67	38 07	38·23	36·66	37·90	38 43	37·40	36·85
Significant difference			1·24					

* Differential attack by Phytalus was probably responsible for this anomalous result.



yields of plots in virgins, 1st and 2nd Ratoons of Beau-Champ.

Virgins; 1st Ratoons; 2nd Ratoons

The question thus arises whether the results at Beau Champ are fundamentally different to those at the other localities, as the possibility cannot be excluded that the best time of application in one environment may not, of necessity, be the best time in another. Against this possibility is the fact that the canes at Beau Champ were known to be attacked by Phytalus. Graphs of the plot yields for the three crops show the considerable effect of Phytalus on yields. The blocks in the figure occupy the same relative position to that which they occupy in the field. It will be seen that in blocks I and III the yields of virgins and 1st ratoons were similar and closely related, the yields in second ratoons, however, were very considerably less implying a heavy attack of Phytalus in these blocks in second ratoons. Blocks II and IV showed low yields in virgins, considerably higher yields in first ratoons and more or less intermediate yields in second ratoons. Apart from Phytalus, there was evidence of a marked drop in fertility towards the extreme right side of the field, which was undoubtedly responsible for the reduced yields of the A plot in Block II and the D plot in Block IV. It does not appear from these data that the A treatment is in the least inferior to the other treatments at Beau Champ: on the other hand, there is no evidence that it is superior to the other treatments either. The data from the other three estates definitely indicate the superiority of the A treatment. It is proposed to continue these experiments for a further crop. It is interesting to note that when these experiments were commenced, no very large differences due to time of application of fertilizers were expected as it was realised that if such large yield differences occurred, such differences would very likely have been established by planters during their long experience of sugarcane culture. The differences which have been found are small, but nevertheless of considerable economical importance, since in addition to giving yields $\frac{1}{2}-1\frac{1}{2}$ tons per acre higher, the application of the fertilizers in one operation is a more economical practice. The trials carried out on this subject were not sufficiently refined to prove such small differences in any one year, but replications on several estates over three crops established the observed differences as being real. It is hoped that by repeating the trials for another crop the significance of the results will be established beyond question. It is intended also to carry out experiments on the best method of applying the fertilizer as this question becomes of importance when the fertilizer is applied in one dose at the beginning of the crop.

An investigation of physiological methods of diagnosing nutrient deficiencies in sugarcane.

Work has been mainly completed on the possible use of leaf and stem injection methods for the diagnosis of nutrient deficiencies and a full report on the subject has been submitted for publication. The method was not considered promising for sugarcane. Much more promising results have been obtained from a growth rate method which was developed from data obtained on the growth of fertilized and

unfertilized plants, and from uniformity (growth rate) trials. Two important facts were established—

(1) That considerable growth responses to fertilizer were only obtained during the season when growth is active following an ample supply of moisture and the existence of high temperatures, *i.e.*, in the period mid-December to mid-April in most parts of Mauritius. Differences in the growth rate of fertilized and unfertilized canes at other times of the year were insignificant. It was necessary, therefore, to confine the observations to this period.

(2) The variability in the absolute growth rate of stools was so high that an impracticably large number of stools would have to be measured to prove reasonable differences. It was found, however, that there was a very close relationship between the growth which any one stool made in a period of, say, one month and the growth made by the same stool in a subsequent following month. Correlation coefficients of + 0·89 to + 0·92 were obtained between the growth rate during a preliminary period and that during a subsequent period.

It is on these facts that the method adopted is based. Twenty-five stools occurring in the field on which a 5 × 5 latin square lay out may be imposed were chosen (*i.e.*, five stools in five rows). The growth increment (in terms of total length of cane per stool) was determined for each of these twenty-five stools for a preliminary period of one month. A latin square design involving the treatments: nothing, nitrogen only, potash only, phosphate only, and nitrogen, phosphate and potash was imposed on these twenty-five stools, the treatments applied and the growth increment for a period of one month following the treatments determined.

The method of treating the results will be apparent from the following analysis of an actual experiment carried out in the Flacq district—

Monthly growth increment before applying the fertilizer					*Monthly growth increment following the applications of fertilizer*					*Differences for each stool, between growth before and after applying the fertilizers*				
148	154	97	184	154	*P* 223	*N* 334	*K* 220	*O* 265	*NPK* 459	*P* + 75	*N* + 80	*K* +123	*O* + 81	*NPK* +305
160	60	194	134	134	*O* 152	*P* 197	*N* 314	*NPK* 466	*K* 257	*O* − 8	*P* +117	*N* +120	*NPK* +332	*K* +123
160	102	149	207	154	*K* 250	*NPK* 273	*O* 235	*P* 318	*N* 242	*K* + 90	*NPK* +171	*O* + 86	*P* +111	*N* +107
224	203	173	153	119	*N* 409	*O* 249	*NPK* 374	*K* 228	*P* 163	*N* +185	*O* + 46	*NPK* +201	*K* + 75	*P* + 44
201	275	229	170	119	*NPK* 491	*K* 360	*P* 250	*N* 292	*O* 158	*NPK* +290	*K* + 85	*P* + 21	*N* +122	*O* + 39

The differences between the growth increment of each stool in the preliminary period and those in the period following the treatments are analysed by Fisher's analysis of variance.

The result of this analysis is given below—

	O	N	P	K	NPK	General Mean	Sig. diff.
Mean differences between "preliminary" and "experimental" growth increments ...	+48·8	+122·8	+73·6	+99·2	+259·8	+120·8	70·16
Differences between "treatment" and controls ...	0	+ 74·0	+24·8	+50·4	+211·0	—	70·16

The fact that there was an increase in the "Nothing" stools between the "preliminary" and "experimental" period merely means that growth conditions happened to be slightly better during the latter period. It is obvious that this is sometimes the contrary. To analyse the effects of the treatments these are compared with the "Nothing" stools. It is apparent that nitrogen alone caused a significant increase in the growth increment, whereas the increments due to potash and phosphate alone were not significant.

The three fertilizers together gave a highly significant growth increment; indicating that there was a marked interaction effect. A satisfactory correction of the state of fertility of this field would thus have necessitated the application of a complete fertiliser. In several other similar experiments deficiencies of the elements N, P and K individually were proved and in some, interaction effects similar to that in the above experiment were indicated.

This method has been shown to have considerable value since the increased growth increments resulting from fertilizer treatments is the direct forerunner of increased yields.

The fact that positive results are obtained in a period of 2 months makes it possible to apply the results with benefit to the current crop. The method has also the advantage of being within the capacity of practical agriculturists.

It is hoped to publish a full account of these methods of diagnosing nutrient deficiencies in the *Annals of Botany*.

Trash Disposal Experiments

Experiments on this subject, which have been in progress since 1938 were continued during the present year in modified form. In previous years no increases in yield resulted from burying trash in various ways as compared to heaping trash on the surface of alternate interlines. This result was once more confirmed in 1941 in large scale experiments with plots 1/10 arpent replicated 14 times, the issue being confined to heaping trash on the surface against burying trash. Differences in yield were 0·2—0·3 tons p.a. compared to 1—2·5 tons required for significance.

Physiological investigations on the basis of resistance to Red Rot disease (Colletotrichum falcatum, Went) in Sugarcane varieties.

A considerable amount of work on this subject has been carried out in collaboration with the Plant Pathologist. This work is still incomplete and will be reported in full, later. It has been shown, however, that the degree of resistance or susceptibility to the disease

in sugarcane varieties is associated with the content of a substance which appears to be an amino-phenol of the tyrosine type. Two chemical methods of estimating the content of this substance have been used and remarkably close correlation found between the known behaviour of varieties to the disease and the content of the unknown substance. In the intermediate range, borer resistance as measured by the lignin content of the rind also appears to play an important role. It would appear, however, that very susceptible or very resistant types may be immediately selected by determination of the content of the substance concerned using the chemical methods mentioned above.

Planting in furrows v. planting on ridges in wet districts.

The trial on this subject at Tivoli which was described in the last Annual Report was harvested as first ratoons in 1941. The yields in virgins and first ratoons are given below—

	Furrow planting	*Ridge planting*	*Difference in favour of ridge planting*	*Significant difference*
Virgins 1940 (tons per arpent) ...	26·2	29·3	3·1	2·9 tons
1st ratoons 1941	21·5	29·2	7.7	3·5 tons
Total (two crops) ...	47·7	58·5	10·8	—

The increase in yield in the ridge planting was considerably greater in first ratoons than in plant cane. Of the several factors which may be responsible for this increase in yield, the following are probably the most important:

1. A greater degree of water-logging in wet weather in the furrow planting. Water-logging may be responsible for complete mortality of stools or merely reduced growth as a result of a restricted oxygen supply to the roots and toxic accumulations of carbon dioxide. Mortality of stools was, in fact, 15% in the furrow planting as compared to 10% in the ridge planting.

2. A greater proportion of the richer top soil is exploited by the roots in the ridge planting as compared to the furrow planting. On such poor soils as are often found in the wet districts such a localisation of the root system may have a stimulating effect on the growth of the cane.

3. Temperature effects may be involved; the more superficial ridge plants being subjected to higher temperatures resulting in increased tillering after the harvesting of the previous crop. Temperature is known to have a marked effect on the production of new shoots from the stubble left after the harvesting of the previous crop. Shoot counts showed that the ridge-planted stools did have more shoots per stool than the furrow-planted stools though this difference just failed to reach significance.

It was apparent to the eye that the canes were longer in the ridge-planting. The increased yield was thus partly due to a larger number of canes per stool, partly to longer canes and partly to a lesser

mortality of stools. There is thus little doubt that unfavourable factors operating in this type of environment, are, to a considerable extent, overcome by planting on flat ridges separated by furrows 6–8 inches deep. The soil which is washed down into the furrows in the ridge planting is used for earthing-up the stool.

There is little doubt that this method of planting should be seriously considered for the very wet districts.

Some experiments on factors affecting germination of cuttings.

In past years some of the important factors affecting germination of cuttings have been investigated and as a result of this work, the practice of soaking cuttings in a saturated solution of lime water is now almost universally followed in Mauritius, with very beneficial results. In the case of the Sugarcane Research Station seedling M.171/30 some trouble still occasionally occurs, the germination being often slow and uncertain, particularly under adverse climatic conditions, and considerable recruiting may have to be resorted to.

Some further experiments were, therefore, carried out with this variety. The experiments were made to test the effect of soaking in (1) lime water, (2) 10% ethyl alcohol, associated with applications of molasses at varying periods before planting, and also to compare dusting with ceresan powder and soaking in ceresan solution with and without the application of molasses. The results of these experiments may be summarised as follows—

(1) In a small scale experiment (4×4 latin square) including the treatments (*a*) no molasses, (*b*) molasses three weeks before planting, (*c*) molasses ten days before planting and (*d*) molasses at planting; (*b*) and (*c*) were somewhat better than (*a*) but (*d*) was distinctly worse. It would, therefore, appear that molasses should not be applied at planting but at least one week before planting.

(2) The *a*, *b*, *c* and *d* plots were each divided into three subplots in which the cuttings were (1) not soaked (2) soaked in lime water, (3) soaked in 10% alcohol. Soaking in lime was beneficial in all the *a*, *b*, *c* and *d* treatments, being superior to "not soaked" in all the plots. Soaking in 10% alcohol was only superior to no soaking in the *a* plots (no molasses) there being no difference in the plots which received molasses. It would, therefore, appear that molasses exerts its stimulative effects on germination through the alcohol formed on fermentation.

(3) In a larger scale trial (3×2 factorial experiment), the first factor included (*a*) controls, (*b*) dusted with ceresan powder, (*c*) dipped in ceresan suspended in water (one oz. to the gallon), the second factor being (1) no molasses, (2) molasses applied at the rate of 4 tons per acre, one week before planting. The results of this trial definitely showed the beneficial effect of molasses applied one week before planting on germination and also the very marked beneficial effect of ceresan. There was no difference between dusting with ceresan and dipping the cuttings in ceresan suspended in water. Molasses caused an increase of 18% in the final number of cuttings germinated (mean of all treatments) and had a still greater effect on the rate of germination. In the plants treated with ceresan (either dusted or dipped in solution) a

germination of 97·5% was obtained compared to a final germination of 70% in the controls.

Since dipping in ceresan solution is much more practicable than dusting with the powder, this procedure is advocated.

These trials were carried out in the cold winter months under adverse weather conditions.

Investigation of a possible method of assessing Phytalus damage with a view to adapting it to measure the susceptibility of different varieties.

This work was carried out with the co-operation of the Geneticist and consisted of an attempt to utilize growth data to evaluate Phytalus damage. From preliminary grubbings—a field having a high Phytalus information was chosen for the work.

Fifty-four stools consisting of 9 stools in each of 6 cane rows were measured on 13th May, and were left until 14th July, when they were again measured. On this latter date each stool was carefully removed and all the larvæ associated with it counted, the purpose being to see whether there was any relationship between the growth made in the two month interval and the number of larvæ associated with the stools. Although the number of larvæ associated with each stool varied from a minimum of 2 to a maximum of 58 there was no correlation whatsoever between the amount of growth made and the number of larvæ attacking the stool.

It is possible that the experiment was made somewhat late in the year, or that previous infestations had permanently weakened the stools. It would, therefore, be desirable to repeat this experiment on plant canes in their first infestation.

Harvest results of the time of planting trial at Colmar, Britannia S.E.

The co-operative experiment designed to investigate the effect of the time of planting on Phytalus infestation was harvested by the Botanical Division. Plantings were made in July, October and December, 1939, and in March and May, 1940. The 1939 plantings were harvested as plant canes in November, 1940, and as first ratoons in October, 1941. The 1940 plantings were harvested as plant canes in 1941. The yields were as follows —

	Plantations made				
	July 1940	*October 1939*	*December 1939*	*March 1940*	*May 1940*
1939 Yields (tons per arpent) ...	36·3	37·8	31·6	—	—
1940 Yields (tons per arpent) ...	40·0	42·3	42·5	38·5	36·0
Total yields ...	76·3	80·1	74·1	38·5	36·0
Number of months to produce total yield	27	24	21	19	17
Yield in tons per month ...	2·83	3·34	3·53	2·03	2·12

It would appear that plantations made about October would be the most economical for the variety M.168/32 in this locally.

Weed Eradication Experiments.

This work which was commenced some years ago has been renewed using methods based on the work of Bates (1940). This method involves cuttting the weeds and applying sodium chlorate in a

comparatively strong solution to the cut surface. The chlorate is absorbed into the underground portions of the plant—the rate of absorption being dependent mainly on the water-deficit in the plant at the time of cutting. Bates has devised methods of cutting the weeds and smearing the cut ends with the chlorate solution in one operation, and through the courtesy of the British Rubber Publicity Association a scythe fitted with the devise has been received for experimental purposes.

Preliminary experiments have shown that the principle of the method is sound—a variety of weeds having been destroyed in one operation. Some graminaceous weeds, however, appear to be more resistant to the treatment annd several cuttings may be required to eradicate these.

Experiments are now in progress to determine whether the scythe or other cutting instrument fitted with a device for supplying chlorate may be used in practical cane culture.

Experiments on the Control of Sugarcane Borer.

Some preliminary experiments have been carried out in collaboration with the Entomological Division on possible methods of controlling cane borer. Cane plants 8 months old grown in the greenhouse in sand culture were used for the experiments. Some were treated with cryolite synthetic mineral compound by dusting the leaves with the dry powder, while others kept as controls were untreated. Clusters of borer eggs were obtained by the Entomologist and pinned to the leaves of all the the plants. The eggs hatched in a few days on both treated and control plants—the young larvæ on the control plant developed normally, feeding on the leaves and penetrating the spindle. On the treated plants all the larvæ were killed and no feeding could be detected on the leaves.

Since cryolite is not at present available in large quantities attempts are being made to cause the cane plant to absorb substances which may be toxic to the borer.

Spacing Trials.

Several factorial experiments with varieties, spacing and fertilizer levels as variables have been laid down. These will be harvested as plant canes in 1942.

Growth measurements.

Growth measurements of released varieties and promising seedlings are being made to obtain data on the periodicity of their growth cycle and indications as to their suitability for different localities and climatic conditions.

Other investigations.

Other investigations of a preliminary character particularly on the specific requirements for growing cane satisfactorily in culture solutions and sand cultures were carried out during the year, attention being paid to the best chemical solutions, pH, and aeration of the cultures.

The Botanist was also engaged on the food growing scheme in the Black River and Plaines Wilhems districts.

H. EVANS,
Botanist.

APPENDIX

List of Publications of the Sugarcane Research Station, Department of Agriculture, Mauritius.

I. Reports

Report on a visit to the Proefstation-Oost-Java in March–April, 1930, by A. Glendon Hill. (out of print).

First Annual Report, 1930. (out of print).

Second Annual Report, 1931.

Third Annual Report, 1932.

Fourth Annual Report, 1933. (out of print).

Fifth Annual Report, 1934.

Sixth Annual Report, 1935.

Seventh Annual Report, 1936.

Eighth Annual Report, 1937.

Ninth Annual Report, 1938.

Tenth Annual Report, 1939.

Eleventh Annual Report, 1940.

II. Bulletins

Bulletin No. 1 —

(a) Results of Manurial Experiments harvested in 1931 and 1932 ;

(b) Results of Variety Trials harvested in 1931 and 1932 ; by N. Craig, M.SC. (1933).

Bulletin No. 2 —

Preliminary investigations of the growth rate of the Sugarcane ; by A. Glendon Hill, B.A., B.AGR., A.R.C.SC.I., and H. Evans, PH.D. (1933). (out of print).

Bulletin No. 3—

Some preliminary data concerning the best shape and size of plot, for field experiments with Sugarcane ; by H. Evans, PH.D. (1934). (out of print).

Bulletin No. 4—

Some properties of the sugarcane soils of Mauritius ; by N. Craig, M.SC. (English and French Editions). (1934). (out of print).

Bulletin No. 5—

Studies on root exudation and root type in Sugarcane ; by H. Evans, PH.D. (1934). (out of print).

Bulletin No. 6—

Investigations on the root system of sugarcane varieties ; by H. Evans, PH.D. (1935) (out of print).

Bulletin No. 7—

Investigations on the course of growth in a virgin or plant crop of sugarcane ; by H. Evans, PH.D. (1935).

Bulletin No. 8—

The maintenance of first year characters in new sugarcane clones ; by A. Glendon Hill, B.A., B.AGR., A.R.C.SC.I. (1935).

Bulletin No. 9 —

Base exchange relationships in Mauritius soils ; by N. Craig, M.SC. (1935).

Bulletin No. 10—

Some data on the effect of a late heavy dressing of nitrogenous fertilizer on the growth metabolism of sugarcane in Mauritius ; by H. Evans, PH.D. (English and French Editions). (1936).

ulletin No.—11

Sugarcane in Mauritius : A review of the present position with respect to its cultivation and manuring ; N. Craig, M.SC. (English aud French Editions). (1937).

ulletin No. 12—

Further investigations on the root-system of sugarcane ; by H. Evans, PH.D. (English and French Editions). (1937).

ulletin No. 13 -

An annotated catalogue of varieties in Mauritius ; by A. Glendon Hill, B.A., B.AGR., A.R.C.SC.I. (1937).

ulletin No. 14—

A preliminary study of root characters as affecting drought resistance in two sugarcane varieties and in their seedlings ; by H. Evans, PH.D. (1937).

ulletin No. 15—

The inheritance of gumming disease resistance in sugarcane breeding; by G. C. Stevenson, B.A. (Cantab), A.I.C.T A. (1939).

ulletin No. 16—

A botanical and agricultural description of some sugarcane varieties raised by the Sugarcane Research Station, Mauritius ; by H. Evans, PH.D., and G. C. Stevenson, B.A. (Cantab), A.I.C.T.A. (1939).

ulletin No. 17—

An investigation into the origin of the sugarcane variety Uba Marot ; by G. C. Stevenson, B.A. (Cantab), A.I.C.T.A.

The spread of new varieties of sugarcane in Mauritius ; by N. Craig, M.SC. (1940).

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publications of the Department of Agriculture, other than those of the Sugarcane Research Station, applications should be made to the Director of Agriculture, Réduit.

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